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Airport Bird Threat in North America from Large Flocking Birds (geese) (as Viewed by an Engine Manufacturer)--Part 1

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OVERVIEW

In worldwide aviation operations, bird collisions with aircraft and ingestions into engine inlets present safety hazards and financial loss through equipment damage, loss of service and disruption to operations. The problem is encountered by all types of aircraft, both military and commercial.

Modern aircraft engines have achieved a high level of reliability while manufacturers and users continually strive to further improve the safety record. A major safety concern today includes common-cause events which involve significant power loss on more than one engine. These are externally-inflicted occurrences, with the most frequent being encounters with flocks of birds. Most frequently these encounters occur during flight operations in the area on or near airports, near the ground instead of at cruise altitude conditions.

This paper focuses on the increasing threat to aircraft and engines posed by the recorded growth in geese populations in North America. Service data show that goose strikes are increasing, especially in North America, consistent with the growing resident geese populations estimated by the United States Department of Agriculture (USDA). Airport managers, along with the governmental authorities, need to develop a strategy to address this large flocking bird issue.

This paper also presents statistics on the overall status of the bird threat for birds of all sizes in North America relative to other geographic regions. Overall, the data shows that Canada and the USA have had marked improvements in controlling the threat from damaging birds - except for the increase in geese strikes.

To reduce bird ingestion hazards, more aggressive corrective measures are needed in international air transport to reduce the chances of serious incidents or accidents from bird ingestion encounters. Air transport authorities must continue to take preventative and avoidance actions to counter the threat of birdstrikes to aircraft.

The primary objective of this paper is to increase awareness of, and focus attention on, the safety hazards presented by large flocking birds such as geese. In the worst case,

multiple engine power loss due to large bird ingestion could result in an off-airport forced landing accident. Hopefully, such awareness will prompt governmental regulatory agencies to address the hazards associated with growing populations of geese in North America.

BIRD INGESTION ACCIDENTS WITH FATALITIES

Although costs associated with birdstrikes are incurred by most airlines, they generally do not have the leverage to drive airport managers to institute more effective airport bird hazard controls. Unfortunately, it is the safety threat posed by birds at and near airports, sometimes in the aftermath of an accident, that focuses the need for improved airport bird control programs. This is illustrated from selected well-known events in the history of fatal accidents.

- In September of 1988, a Boeing 737-200 ingested a large number of speckled pigeons in both engines during takeoff at Bahar Dar, Ethiopia. During the air turn-back, both engines lost power. While attempting an off-airport landing, the aircraft struck a river bank and burned.

- In January of 1995, a Falcon 20 encountered a large flock of lapwings during initial climb from LeBourget, France. Bird ingestion damage to the affected engine resulted in an on-board fire from uncontained engine fragments impacting the aircraft fuel system. During the air turnback, the aircraft struck the ground and was destroyed.

- In September of 1995, a US Air Force AWACs aircraft encountered a flock of Canada geese during takeoff rotation at Elmendorf Air Force Base near Anchorage, Alaska. Both left wing engines had ingested geese and lost power. The aircraft crashed.

These events all of which involved fatal injuries point out the need for better bird hazard control programs at and near airports as well as the need to enforce the existing bird control measures and operating procedures.

THREAT POSED BY LARGE FLOCKING BIRDS - GEESE

Although the frequency of ingesting large birds in migratory or intermediate flocks has been very low, observed geese populations have been increasing in size in North America and have been accompanied by an increase in goose strikes to aircraft in the United States.

Geese Population Growth in North America

Geese population measurements provided by the USDA show a significant (10:1) increase in the resident Canada goose population in North America in recent years. The number of resident (non-migrating) geese has increased from ~200,000 in 1970 to over ~ 2,000,000 in 1997. See Figure 1.

***USDA National Wildlife Research Center**
***John L. Seubert, Biologist, USD**

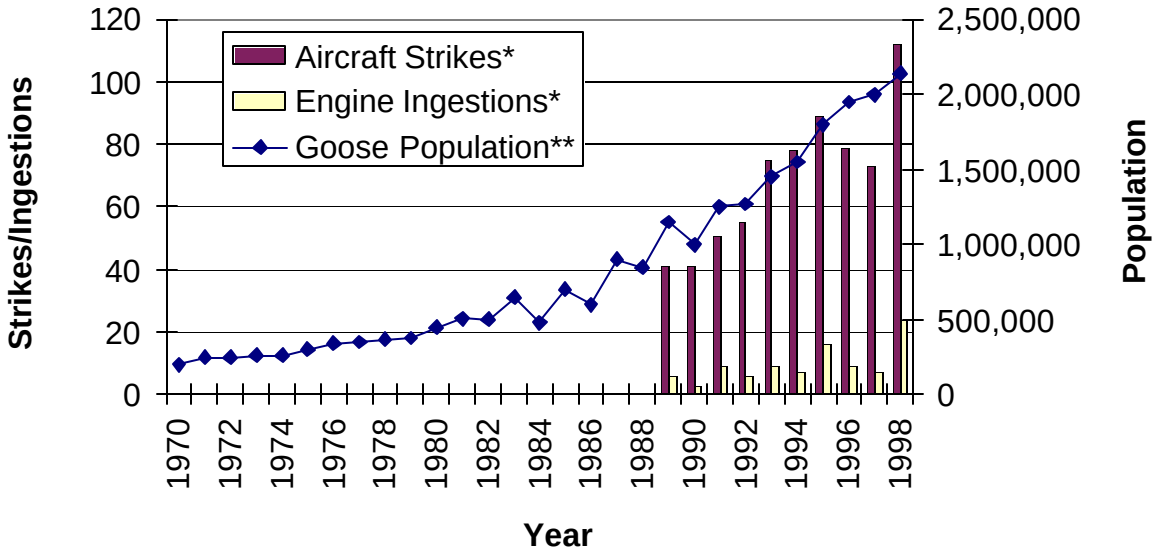

Figure 1 North American Resident Goose Population Growth and Aircraft Goose Strikes & Goose Ingestions in the USA.

Goose Strikes Increases in USA

Birdstrike data (aircraft and engine strikes) in the USA, as compiled in the FAA database, show a significant increase in number of goose strikes during the past 10 years, consistent with the increasing goose population in North America, as also shown in Figure 1. Strikes prior to 1989 do not appear as comparable industry data were not available in the FAA database.

Analyses of these industry data in the USA show that the increase in goose strikes to aircraft (and engines) is statistically significant and the rate of "strikes" is currently growing by approximately 3-4% per year. Figure 2 shows the growing trend in yearly rate of aircraft strikes by geese along with 95% confidence bands. If the growing population of these geese in North America is not arrested, it is estimated that the number of aircraft strikes by geese will increase from 110 strikes per year in 1998 to approximately 300 aircraft strikes per year by the year 2008. This estimate reflects the expected increase in aircraft operations in future years as well as the estimated unabated increase in geese population.

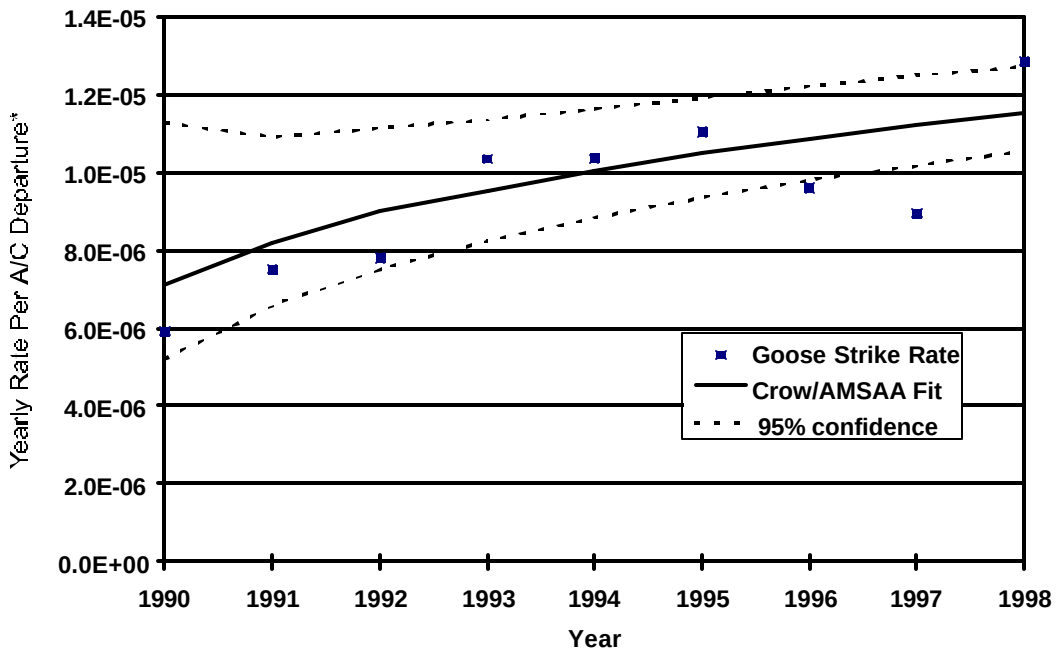

Figure 2 Annual Aircraft Goose Strike Rates in North America

Conclusions

1. The increasing goose ingestion rate per aircraft departure is real and appears to be related to the growing population of Canada Geese and Snow Geese in North America.

2. The increasing number of goose strikes in North America in recent years is related to both the increasing number of aircraft operations (i.e. departures) and the growing population of Canada Geese.

Recommendations

1. Airport Authorities need to implement effective wildlife management programs on airports to address the growing population of geese as well as other flocking birds. There needs to be zero tolerance for grazing geese at airports.

2. The US Department of Interior's US Fish and Wildlife Service need to initiate actions to humanely reduce the rapidly growing population of geese and remove them from airports and airport vicinities to mitigate the hazard to aviation as posed by geese flocks.

The Threat - Case History Examples

Commercial high bypass turbofans have established an outstanding record of safety with respect to the world wide bird threat exposure. The concern is that with the growing goose populations in North America, the threat of a multiple engine goose ingestion on takeoff, which is now extremely remote, will increase to an unacceptably high level. The following case histories provide supporting evidence of the damaging consequences from geese flock encounters and the need to address the growing geese population.

B747 Geese Encounter at Calgary

An illustration of a geese flock exposure with single engine ingestion was a Boeing 747 encounter with a flock of Greater Canada Geese on approach to Calgary in 1992. This encounter is shown in Figures 3 and 4. This event resulted in one goose being ingested in the left outboard engine. Damage to the engine was heavy and fortunately there was no significant power loss.

Figure 3 Boeing 747 Encounter with a Flock of Canada Geese just prior to Bird Ingestion in Outboard Left Wing Engine. Birds appear to be unaware of aircraft's presence.

Figure 4 Same Event a short time later. Birds are now aware of aircraft and have initiated evasive actions.

E4 Snow Goose Encounter in Nebraska

An illustration of a goose flock threat with multiple engine ingestions, was an encounter by an E4B aircraft (a military version of the B747-200) where two of the four engines were heavily damaged. The bird collision occurred at nighttime while climbing through a flock of migrating geese over Nebraska. As the aircraft climbed in darkness at approximately 2230 feet altitude, two miles beyond the departure end of the runway, multiple impacts were felt and the aircraft yawed to the left.

Geese were ingested in numbers 1 and 2 engines; numbers 3 and 4 were undamaged. The throttles on engines numbers 1 and 2 were retarded, the crew declared an emergency and returned the aircraft to a safe landing.

Inspection of the aircraft revealed damage to numbers 1 and 2 engines. Typical damage is shown in Figure 5. The engine cowl had dents and tears in the wing leading edges, leading edge flaps, trailing edge mid-flaps, flap track canoe and radome. There was evidence of 21 goose impacts on the aircraft. A total of 49 geese were confirmed as killed based upon bird debris evidence and actual recovered dead birds:

- There were 38 dead carcasses of Snow Geese and Blue Geese found in a field beneath the impact location.

  In the midair collisions, 5 geese had become (embedded) passengers when they boarded the aircraft by penetrating through holes and tears in the aircraft